Physics High

Student Laboratory Investigation Guide

Verifying the Inverse Square Law of Light

Student Name: _____

Date: _____

Class Period: _____

1. Lab Objectives

In this activity, you will use the interactive simulation to change the distance between a light bulb and a wall. By collecting data across different distances, you will:

- See how the diameter of the light circle grows larger as you move the lamp further away.
- Measure how the brightness (intensity) drops off as the lamp gets more distant.
- Graph your results and turn them into a straight line to prove the Inverse Square Law.

2. How to Use the Interactive Simulation

Access www.physicshigh.com/inverse-square-law-interactive.html

Follow these steps to collect data from the simulation screen:

1. **Moving the Lamp:** Click and drag the grey lamp assembly left and right along the track in the side profile view (left box).
2. **Finding Distance (r):** Look at the base of the lamp. Find the white vertical marker line and see where it points on the ruler beneath it. This tells you your distance from the wall in meters (where the wall is at 0.0m).
3. **Measuring the Light Circle (d):** Look at the target wall view (right box). Move the blue ruler up or down by dragging it. Line it up with the top and bottom edges of the glowing circle to measure its full diameter.
4. **Recording Intensity (I):** Find the real-time brightness percentage in the box at the top-left corner of the target room view.

3. Part A: Collecting Your Data

Move the lamp to 10 different distances between 0.5m and 5.0m. Record your measurements in the table below, then fill out the calculated columns for Radius (R), Area (A = πR²), and Inverse Square Distance (1 / r²).

Trial	Distance (r) (m)	Diameter (d) (m)	Intensity (I) (%)	Radius (R) (R = d / 2, m)	Area (A) (A = πR²)	Linear Value (1 / r²)
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

4. Part B: Graphing Your Results

Use graph paper or a software program like Excel to make two separate graphs from your data table. Make sure to title your graphs, label the axes with units, and plot your points carefully.

- **Graph 1 (Raw Curve):** Plot Intensity (I) on the vertical y-axis and Distance (r) on the horizontal x-axis. Draw a smooth, curved line of best fit through your plotted points.
- **Graph 2 (Linearised Line):** Plot Intensity (I) on the vertical y-axis and your calculated values for 1 / r² on the horizontal x-axis. Draw a straight, linear line of best fit through these points.

5. Part C: Follow-Up Questions

1. Look at Graph 1. Describe the shape of the line you drew. What happens to the brightness of the light as the lamp gets further away from the wall?

2. Compare Graph 1 (the curve) to Graph 2 (the straight line). Why do you think scientists try to turn curved graphs into straight lines when looking at experimental data?

3. Check your calculated numbers for the cross-sectional Area (A). How does the area of the light circle change compared to the distance (r)? Is it a linear change or something else?

4. Using what you noticed about the area growing and the brightness dropping, explain in your own words why light has to get dimmer following an inverse-square pattern as it spreads out.

5. Find the slope (gradient) of your straight line in Graph 2. Show your calculations below, including your chosen points, formulas, and units.

6 . Assuming that the light is a point source. How can we use this data to determine the power output ?